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1 [Level set and PDE methods for computer graphics](#)



David Breen, Ron Fedkiw, Ken Museth, Stanley Osher, Guillermo Sapiro, Ross Whitaker

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '0**

Publisher: ACM Press

Full text available: [pdf\(17.07 MB\)](#)

Additional Information: [full citation](#), [abstract](#)

Level set methods, an important class of partial differential equation (PDE) methods, define dynamic surfaces implicitly as the level set (iso-surface) of a sampled, evolving nD function. The course begins with preparatory material that introduces the concept of using partial differential equations to solve problems in computer graphics, geometric modeling and computer vision. The will include the structure and behavior of several different types of differential equations, e.g. the level set eq ...

2 [GPGPU: general purpose computation on graphics hardware](#)



David Luebke, Mark Harris, Jens Krüger, Tim Purcell, Naga Govindaraju, Ian Buck, Cliff Woolley, Az Lefohn

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '0**

Publisher: ACM Press

Full text available: [pdf\(63.03 MB\)](#)

Additional Information: [full citation](#), [abstract](#)

The graphics processor (GPU) on today's commodity video cards has evolved into an extremely powerful and flexible processor. The latest graphics architectures provide tremendous memory bandwidth and computational horsepower, with fully programmable vertex and pixel processing units that support vector operations up to full IEEE floating point precision. High level languages have emerged for graphics hardware, making this computational power accessible. Architectural GPUs are highly parallel s ...

3 [Real-time volume graphics](#)



Klaus Engel, Markus Hadwiger, Joe M. Kniss, Aaron E. Lefohn, Christof Rezk Salama, Daniel Weiskopf

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '0**

Publisher: ACM Press

Full text available: [pdf\(7.63 MB\)](#)

Additional Information: [full citation](#), [abstract](#)

The tremendous evolution of programmable graphics hardware has made high-quality real-time volume graphics a reality. In addition to the traditional application of rendering volume data in scientific visualization, the interest in applying these techniques for real-time rendering of atmospheric phenomena and participating media such as fire, smoke, and clouds is growing rapidly

This course covers both applications in scientific visualization, e.g., medical volume data, and real time rendering, ...

4 High dynamic range imaging



Paul Debevec, Erik Reinhard, Greg Ward, Sumanta Pattanaik

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '0**

Publisher: ACM Press

Full text available: pdf(20.22 MB)

Additional Information: [full citation](#), [abstract](#)

Current display devices can display only a limited range of contrast and colors, which is one of the main reasons that most image acquisition, processing, and display techniques use no more than eight bits per color channel. This course outlines recent advances in high-dynamic-range imaging from capture to display, that remove this restriction, thereby enabling images to represent the color gamut and dynamic range of the original scene rather than the limited subspace imposed by current monitors ...

5 The elements of nature: interactive and realistic techniques



Oliver Deussen, David S. Ebert, Ron Fedkiw, F. Kenton Musgrave, Przemyslaw Prusinkiewicz, Doug Roble, Jos Stam, Jerry Tessendorf

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '0**

Publisher: ACM Press

Full text available: pdf(17.65 MB)

Additional Information: [full citation](#), [abstract](#)

This updated course on simulating natural phenomena will cover the latest research and production techniques for simulating most of the elements of nature. The presenters will provide movie production, interactive simulation, and research perspectives on the difficult task of photorealistic modeling, rendering, and animation of natural phenomena. The course offers a nice balance of the latest interactive graphics hardware-based simulation techniques and the latest physics-based simulation techniques ...

6 Collision detection and proximity queries



Sunil Hadap, Dave Eberle, Pascal Volino, Ming C. Lin, Stephane Redon, Christer Ericson

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '0**

Publisher: ACM Press

Full text available: pdf(11.22 MB)

Additional Information: [full citation](#), [abstract](#)

This course will primarily cover widely accepted and proven methodologies in collision detection. In addition, more advanced or recent topics such as continuous collision detection, ADFs, and using graphics hardware will be introduced. When appropriate, the methods discussed will be tied to familiar applications such as rigid body and cloth simulation, and will be compared. The course is a good overview for those developing applications in physically based modeling, VR, haptics, and robotics.

7 Shape-based retrieval and analysis of 3D models



Thomas Funkhouser, Michael Kazhdan

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '0**

Publisher: ACM Press

Full text available: pdf(12.56 MB)

Additional Information: [full citation](#), [abstract](#)

Large repositories of 3D data are rapidly becoming available in several fields, including mechanical CAD, molecular biology, and computer graphics. As the number of 3D models grows, there is an increasing need for computer algorithms to help people find the interesting ones and discover relationships between them. Unfortunately, traditional text-based search techniques are not always effective for 3D models, especially when queries are geometric in nature (e.g., find me objects that fit into this ...

8 MPEG-4: an object-based multimedia coding standard supporting mobile applications

Atul Puri, Alexandros Eleftheriadis

June 1998 **Mobile Networks and Applications**, Volume 3 Issue 1

Publisher: Kluwer Academic Publishers

Full text available:  pdf(747.80 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

The ISO MPEG committee, after successful completion of the MPEG-1 and the MPEG-2 standard: currently working on MPEG-4, the third MPEG standard. Originally, MPEG-4 was conceived to be standard for coding of limited complexity audio-visual scenes at very low bit-rates; however, in 1994, its scope was expanded to include coding of scenes as a collection of individual audio-visual objects and enabling a range of advanced functionalities not supported by other standards. One the ke ...


9 Real-time shading



Marc Olano, Kurt Akeley, John C. Hart, Wolfgang Heidrich, Michael McCool, Jason L. Mitchell, Randi Rost

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '0**

Publisher: ACM Press

Full text available:  pdf(7.39 MB)

Additional Information: [full citation](#), [abstract](#)

Real-time procedural shading was once seen as a distant dream. When the first version of this course was offered four years ago, real-time shading was possible, but only with one-of-a-kind hardware or by combining the effects of tens to hundreds of rendering passes. Today, almost every new computer comes with graphics hardware capable of interactively executing shaders of thousands to tens of thousands of instructions. This course has been redesigned to address today's real-time shading capabilities ...

10 Computing curricula 2001



September 2001 **Journal on Educational Resources in Computing (JERIC)**

Publisher: ACM Press

Full text available:  pdf(613.63 KB)  html(2.78 KB)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

11 Facial modeling and animation



Jörg Haber, Demetri Terzopoulos

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '0**

Publisher: ACM Press

Full text available:  pdf(18.15 MB)

Additional Information: [full citation](#), [abstract](#)

In this course we present an overview of the concepts and current techniques in facial modeling and animation. We introduce this research area by its history and applications. As a necessary prerequisite for facial modeling, data acquisition is discussed in detail. We describe basic concepts of facial animation and present different approaches including parametric models, performance-physics-, and learning-based methods. State-of-the-art techniques such as muscle-based facial animation, mass-s ...

12 The Quadtree and Related Hierarchical Data Structures



Hanan Samet

June 1984 **ACM Computing Surveys (CSUR)**, Volume 16 Issue 2

Publisher: ACM Press

Full text available:  pdf(4.87 MB)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

13 Face recognition: A literature survey



W. Zhao, R. Chellappa, P. J. Phillips, A. Rosenfeld

December 2003 **ACM Computing Surveys (CSUR)**, Volume 35 Issue 4

Publisher: ACM Press

Full text available: pdf(4.28 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

As one of the most successful applications of image analysis and understanding, face recognition has recently received significant attention, especially during the past several years. At least two reasons account for this trend: the first is the wide range of commercial and law enforcement applications, and the second is the availability of feasible technologies after 30 years of research. Even though current machine recognition systems have reached a certain level of maturity, their success is ...

Keywords: Face recognition, person identification

14 3D RGB image compression for interactive applications



Chandrajit Bajaj, Insung Ihm, Sanghun Park

January 2001 **ACM Transactions on Graphics (TOG)**, Volume 20 Issue 1

Publisher: ACM Press

Full text available: pdf(2.41 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper presents a new 3D RGB image compression scheme designed for interactive real-time applications. In designing our compression method, we have compromised between two important goals: high compression ratio and fast random access ability, and have tried to minimize the overhead caused during run-time reconstruction. Our compression technique is suitable for applications wherein data are accessed in a somewhat unpredictable fashion, and real-time performance of decompression is necessary ...

15 Feature-based similarity search in 3D object databases



Benjamin Bustos, Daniel A. Keim, Dietmar Saupe, Tobias Schreck, Dejan V. Vranić

December 2005 **ACM Computing Surveys (CSUR)**, Volume 37 Issue 4

Publisher: ACM Press

Full text available: pdf(5.29 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

The development of effective content-based multimedia search systems is an important research issue due to the growing amount of digital audio-visual information. In the case of images and video, the growth of digital data has been observed since the introduction of 2D capture devices; similar development is expected for 3D data as acquisition and dissemination technology of 3D models is constantly improving. 3D objects are becoming an important type of multimedia data with many promising applications ...

Keywords: 3D model retrieval, content-based similarity search

16 Crowd and group animation



Daniel Thalmann, Christophe Hery, Seth Lippman, Hiromi Ono, Stephen Regelous, Douglas Sutton

August 2004 **Proceedings of the conference on SIGGRAPH 2004 course notes SIGGRAPH '04**

Publisher: ACM Press

Full text available: pdf(20.19 MB)

Additional Information: [full citation](#), [abstract](#)

A continuous challenge for special effects in movies is the production of realistic virtual crowds, terms of rendering and behavior. This course will present state-of-the-art techniques and methods. The course will explain in details the different approaches to create virtual crowds: particle systems with flocking techniques using attraction and repulsion forces, copy and pasting techniques, age

based methods. The architecture of software tools will be presented including the MASSIVE softwa ...

17 Clustered principal components for precomputed radiance transfer



Peter-Pike Sloan, Jesse Hall, John Hart, John Snyder

July 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 3

Publisher: ACM Press

Full text available: pdf(9.29 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)

We compress storage and accelerate performance of precomputed radiance transfer (PRT), which captures the way an object shadows, scatters, and reflects light. PRT records over many surface points a transfer matrix. At run-time, this matrix transforms a vector of spherical harmonic coefficients representing distant, low-frequency source lighting into exiting radiance. Per-point transfer matrices form a high-dimensional surface signal that we compress using *clustered principal component analysis* ...

Keywords: *graphics hardware, illumination, monte carlo techniques, rendering, shadow algorithm*

18 Compression Domain Volume Rendering

Jens Schneider, Rudiger Westermann

October 2003 **Proceedings of the 14th IEEE Visualization 2003 (VIS'03) VIS '03**

Publisher: IEEE Computer Society

Full text available: pdf(1.23 MB)

Additional Information: [full citation](#), [abstract](#)

A survey of graphics developers on the issue of texture mapping hardware for volume rendering would most likely find that the vast majority of them view limited texture memory as one of the most serious drawbacks of an otherwise fine technology. In this paper, we propose a compression scheme for static and time-varying volumetric data sets based on vector quantization that allow to circumvent this limitation. We describe a hierarchical quantization scheme that is based on a multiresolution c ...

Keywords: Volume Rendering, Vector Quantization, Texture Compression, Graphics Hardware

19 Statistical geometry representation for efficient transmission and rendering



Aravind Kalaiah, Amitabh Varshney

April 2005 **ACM Transactions on Graphics (TOG)**, Volume 24 Issue 2

Publisher: ACM Press

Full text available: pdf(16.46 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Traditional geometry representations have focused on representing the details of the geometry in a deterministic fashion. In this article we propose a statistical representation of the geometry that leverages local coherence for very large datasets. We show how the statistical analysis of a densely sampled point model can be used to improve the geometry bandwidth bottleneck, both on the system bus and over the network as well as for randomized rendering, without sacrificing visual realism. Our s ...

Keywords: Point-based rendering, network graphics, principal component analysis, programmable GPU, progressive transmission, quasi-random numbers, view-dependent rendering


20 Geometric algorithms for animation: Geometry videos: a new representation for 3D animation

Hector M. Briceño, Pedro V. Sander, Leonard McMillan, Steven Gortler, Hugues Hoppe

July 2003 **Proceedings of the 2003 ACM SIGGRAPH/Eurographics symposium on Computer Graphics**

animation SCA '03

Publisher: Eurographics Association

Full text available:  [pdf\(3.72 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We present the "Geometry Video," a new data structure to encode animated meshes. Being able to encode animated meshes in a generic source-independent format allows people to share experiences. Changing the viewpoint allows more interaction than the fixed view supported by video. Geometry videos are based on the "Geometry Image" mesh representation introduced by et al. ⁴. Our novel data structure provides a way to treat an animated mesh as a video sequence (i.e., 3D image) and is ...

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